

Syllabus for Stat 4302: Computational Statistics

Instructor:

Office:

Office Hours:

Office Phone:

E-mail:

Format: Three credit hours; three 55-minute in-class meetings per week

Prerequisites: Stat 4301 or permission of the instructor

Required Text: *Statistical Computing with R*, Maria L. Rizzo, CRC Press.

Course Description and Learning Outcomes: This course covers a number of topics in the area of computational statistics, using the statistical software R. Students will use their knowledge in theoretical and applied statistics to design and perform classical and modern Monte Carlo experiments. The students will also be exposed to statistical inference based on resampling methods (bootstrap, jackknife and permutation tests).

Upon successful completion of the course, students will be able to

1. Import data sets of various formats into R.
2. Design and perform simple Monte Carlo experiments.
3. Use resampling methods to carry out statistical inference.
4. Produce numerical and graphical summaries of their analysis.
5. Communicate findings through written reports and online tools.

Homework: Homework problems will be assigned and graded weekly.

Exams: There will be two take-home exams: a midterm and a final, both in the format of a small statistical application project. You will be asked to write a report which must be word-processed, and must include numerical and graphical summaries of your analyses as well as your computer code.

Final Grade:

The final course grade will be based on the following weighting of assessment components:

Homework – 30%

Midterm – 30%

Final exam – 40%

Tentative Course Schedule:

Weeks	Topic	Suggested subtopics
1	Introduction to R	R programming environment, R Studio, R Markdown
2, 3	Working with Data in R	data summarization, data types and representation, data visualization
4, 5	Methods for Simulating Random Variables	inverse transform, accept-reject methods, importance sampling, etc.
6, 7	Monte Carlo Methods	Monte Carlo integration, variance reduction, Monte Carlo hypothesis testing
8, 9	Bootstrap & Jackknife, Permutation tests	Bootstrap, jackknife, permutation tests
10, 11, 12	Statistical Inference with Dependent Observations	Dependent observations (time series, spatial data), statistical inference via simulation of dependent variates (simulation of random fields, Gibbs sampling, Metropolis-Hastings algorithms)
13, 14	Numerical Methods in R	Root finding, Newton-Raphson, optimization, EM algorithm, smoothing, etc.

Throughout the course students will be working with modern and complex data sets, including but not limited to: spatio-temporal data, social network data, experimental data. Students will get exposure to retrieving data from on-line repositories (i.e., weather data centers) as well as collecting their own data (i.e., scraping websites). The course will put emphasis on effective and efficient functional programming techniques which will be taught throughout the course via tutorials and examples.

Academic Misconduct: It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct <http://studentlife.osu.edu/csc/>.

Special Accommodations: Students with disabilities (including mental health, chronic or temporary medical conditions) that have been certified by the Office of Student Life Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office of Student Life Disability Services is located in 098 Baker Hall, 113 W. 12th Avenue; telephone 614-292-3307, slds@osu.edu; slds.osu.edu.